JET NOISE AND TURBULENCE

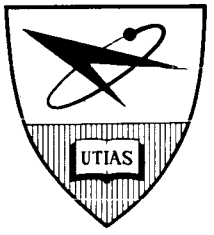
Semi-Annual Progress Report

for Period

November 1/64 to May 1/65

for work performed under

NASA Grant NsG-661



H. S. Ribner
Principal Investigator

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(A) Sound Refraction by a Jet Temperature Field - This project--as discussed in the original Proposal and in the last progress report--has been run concurrently with research on sound refraction by a jet velocity field (funded by AFOSR). References 1 and 2 cover the combined work to about November 1, 1964, the beginning of the period reported here. Since then the major effort has gone into extending the velocity refraction measurements and to preparing a report thereon, while awaiting fabrication of apparatus to extend the temperature refraction measurements.

This apparatus, which has now been largely completed, consists of a horizontal cylindrical steel container for liquid air with a nozzle. An immersed 7.5 KW (max) electric heating element will boil the liquid air at a controlled rate, producing an air jet from the nozzle at liquid air temperature. The 'point' sound source described in the proposal will be placed in the jet for the sound refraction measurements.

(B) Space-Time Pressure Correlations on a Plate Impinged on by a Turbulent Jet - A rough draft report has been prepared by a research assistant on the completed measurements. A revision will be required, however, before publication, and pressure of other matters has prevented progress on this.

Attention is called to the fact that a similar project is being reported by Lyon and Gordon at the 69th Meeting of the Acoustical Society, Washington, D.C., June 2-5, 1965, as follows:

> **BB6. Turbulent Wall Jet as a Broad-Band Shaker.** RICHARD H. LYON AND COLIN GORDON, *Bolt Beranek and Newman Inc., Cambridge, Massachusetts 02138.*—A turbulent jet impinging on an elastic structure can be a convenient source of broad-band mechanical excitation. Recent experimental and theoretical studies of the mechanical power absorbed by a thin plate from a turbulent "wall jet" are described. It is found that the proportional band levels are fairly constant below a "cutoff frequency." This frequency is determined by the pipe diameter and volume flow. At higher frequencies, the excitation drops markedly. The cutoff frequency determines the environmental-frequency régime that a wall jet will simulate. Lower cutoff frequencies require higher volume flows and larger pipes. For these reasons, the wall jet may be more useful in simulating noise environments in the upper and middle audio range, but may be of lesser value at lower frequencies. [Work supported by the U. S. Air Force.]

In their case the stated application is less specific than ours: we proposed the use of such a head-on jet to simulate structural shaking from a parallel jet, in an accelerated fatigue test. The basic idea was stated clearly in our original proposal to NASA ("Jet Noise and Turbulence", December, 1963), and a limited public circulation of

the idea and some partial measurement was afforded by the 1964 Progress Report of the Institute for Aerospace Studies, University of Toronto (Ref. 3). The relevant material from Ref. 3 formed part of the last progress report under the present Grant, covering May 1/64 to November 1/64. A brief mention of one aspect of the measurements was also made in a lecture to the IVICAS Congress, Paris, August 24-28, 1964 (Ref. 4). Thus we have some measure of documentation on a year and a half priority on essentially the same idea.

Aside from the similarity in the basic idea, the degree of overlap in the two researches is not clear. It would seem that Lyon and Gordon are concentrating more on the structural excitation, whereas we have concentrated on the detailed description of the exciting pressure field, in terms of the space-time correlations.

W. A. Hilton

Principal Investigator

REFERENCES

1. Atvars, J., Schubert, L. K. and Ribner, H. S. "Refraction of Sound from a Point Source Placed in an Air Jet." Jour. Acoust. Soc. Amer. 37, No. 1, pp. 168-170, Jan. 1965.

2. Atvars, J., Schubert, L. K. and Ribner, H. S. "Refraction of Sound from a Point Source Placed in an Air Jet", presented at AIAA 2nd Aerospace Sciences Meeting, New York, Jan. 25-27, 1965, AIAA Paper No. 65-82 (supersedes Ref. 1).

3. Anon. "Annual Progress Report 1964", Institute for Aerospace Studies, University of Toronto (Oct. 1964), pp. 45, 46, and Figs. E-6.1, E-6.2.

4. Ribner, H. S. "The Noise of Aircraft" General Lecture, 4th Congress of the International Council of Aeronautical Sciences, Paris, Aug. 24-28, 1964, AIAA Paper No. 64-545; also Univ. of Toronto, Inst. for Aerospace Studies, UTIAS Rev. 24 (Aug. 1964), p. 16.